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AN ASSESSMENT OF WHITE-HEADED WOODPECKERS IN A REGIONAL LANDSCAPE

AN ASSESSMENT OF WHITE-HEADED WOODPECKERS IN A REGIONAL LANDSCAPE

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Abstract. I assessed the distribution, density, and habitat characteristics for forest bird species at point counts in the Interior Columbia River Basin in spring, 1998. Point counts were primarily conducted along road transects, with all points ultimately classified into one of 16 habitat types. This year's field effort spanned three states (Oregon, Idaho, and Washington), 12 National Forests (Boise, Colville, Deschutes, Fremont, Malheur, Nez Perce, Ochoco, Okanogan, Payette, Umatilla, Wallowa-Whitman, and Wenatchee), three Tribal lands (Colville Confederated Tribes, Warm Springs Indian Reservation, and Yakama Indian Nation), as well as state and private lands within the Interior Columbia River Basin Region. A total of 545 points were surveyed between 10 April 1998 and 19 May 1998 on 54 transects with an average of 10 points per transect. A total of 104 bird species were detected during point counts and included 11 woodpecker species, 67 songbird species, 5 waterfowl species, 3 raptor species, 3 shorebird species, 4 gamebird species, 2 owl species, 2 hummingbird species, one kingfisher species, one gull species, one swift species, one nightjar species, one crane species, one dove species, and one rail species. The five most abundant woodpecker species detected during point counts were the Northern Flicker, Williamson's Sapsucker, Hairy Woodpecker, Red-naped Sapsucker, and White-headed Woodpecker. Five Black-backed Woodpeckers were detected, none of which occurred in post-fire habitat types. The total density for all species ranged from 4.33 birds/40 ha in young ponderosa pine/Douglas-fir to 480.34 birds/40 ha in understory reinitiations. There was no difference in the density of birds/40 ha among habitat types (ANOVA, $F_{11, 1272} = 1.482$, $P = 0.132$). Species richness was lowest in young lodgepole pine and greatest in mature ponderosa pine.

A total of 76 White-headed Woodpeckers were observed on 29 transects (59 points). Of those White-headed Woodpeckers detected during point counts, 27 (50.9%) were detected during the first 3 minutes, 5 (9.4%) were detected in the next two minutes, and 21 (39.6%) were detected during the tape-playback sequence ($n = 53$). Detection distances for White-headed Woodpeckers averaged 77.577 ± 4.958 m SE ($n = 52$; range: 16-189 m) during all intervals. Density estimates for White-headed Woodpeckers ranged from 0.13 birds/40 ha in understory reinitiation habitat types to 5.36 birds/40 ha in old mixed-coniferous habitat types. Although the highest estimated density for White-headed Woodpeckers occurred in the old mixed-coniferous habitat type, upon closer inspection, all White-headed Woodpecker detections included in this analysis for the mixed-coniferous habitat type were in ponderosa pine/western larch/Douglas-fir forest types. Thus, the high density estimate obtained for this habitat type is consistent with a ponderosa pine association and does not imply an association with what is typically considered a mixed-conifer forest type.

Key words: Density; Interior Columbia River Basin; point count; old ponderosa pine; Picoides albolarvatus albolarvatus; *White-headed Woodpecker.*

INTRODUCTION

The northern White-headed Woodpecker (*Picoides albolarvatus albolarvatus*) occurs throughout montane coniferous forests of the West--chiefly east of the Cascade summit in the Pacific Northwest--and is resident from south-central British Columbia to the southern Sierra Nevada of California (Bent 1939, Jewett et al. 1953, A.O.U. 1957, 1976, Weber and Cannings 1976, Garrett et al. 1996). Because of the apparent dependence on mature and old-growth ponderosa pine (*Pinus ponderosa*) in its northern range, the White-headed Woodpecker has attracted the attention of land managers and scientists. The continued fragmentation, low snag densities, and conversion to fir-dominated stands imposes serious consequences to the persistence of White-headed Woodpeckers by limiting foraging and breeding habitat, isolating populations, and limiting dispersal.

The White-headed Woodpecker remains one of the least-studied woodpeckers in North America (Garrett et al. 1996). Although a body of knowledge links these birds to open stands of mature and old-growth ponderosa pine in their northern range (Cooper 1969, Burleigh 1972, Weber and Cannings 1976, Cannings 1995, Steeger et al. 1996, Marshall 1997), there is a paucity of abundance, home range, and habitat data on White-headed Woodpeckers in the Pacific and Intermountain Regions of the northwest--with the exception of work in Oregon (Bull 1980, Bull et al. 1986, Dixon 1995*a,b*, Frenzel and Popper 1998) and Idaho (Frederick and Moore 1991).

The loss of habitat, specifically large diameter live and dead ponderosa pine, poses the greatest threat to White-headed Woodpeckers in their northern range. A great deal of what was once suitable habitat for White-headed Woodpeckers has been rendered unsuitable either through silvicultural practices or stand conversions (as a result of fire suppression) to Douglas-fir (*Pseudotsuga menziesii*) and true fir (*Abies* spp.) (Oliver and Ryker 1990, Langston 1995). Old-growth ponderosa pine forests in the northern Rocky Mountains, Intermountain West, and eastside Cascades represent some of the most imperiled major forest types (85-98% decline) (Noss et al. 1995). Sixty to 70% of old-growth ponderosa pine (*Pinus ponderosa*) forests in Idaho are degraded from fire suppression; more accessible areas are high-graded (B. Moseley, Idaho Conservation Data Center, Nongame and Endangered Wildlife Program, Boise, Idaho, personal communication to Noss et al. 1995). There has been an estimated 92-98% loss of old-growth ponderosa pine forests in the Deschutes, Fremont, and Winema National Forests of Oregon (Eastside Forests Scientific Society Panel 1993). Noss et al. (1995) attribute the loss of biodiversity in the United States not only to the extinction of individual species, but to the imperilment of entire ecosystems.

Marshall (1997) compiled White-headed Woodpecker sightings for Oregon and Washington from several sources and created a distribution map based on these sightings. This was also completed in Idaho by Blair and Servheen (1995). These reports increase our knowledge of the distribution of White-headed Woodpeckers, but they do not represent a systematic survey of the birds region-wide, nor do they provide abundance data or habitat associations.

The abundance of White-headed Woodpeckers appears to decrease north of California, but no estimates of total population size are available (Garrett et al. 1996). Furthermore, because

Breeding Bird Survey (BBS) routes do not adequately cover the range of White-headed Woodpeckers, no clear population trends are evident (Garrett et al. 1996, Marshall 1997). Garrett et al. (1996) cite among several research priorities the need to delineate White-headed Woodpecker metapopulations and to document the effects of changing forest tree species composition on these populations.

Because of this loss of habitat, the White-headed Woodpecker (*Picoides albolarvatus*) is a sensitive species in the "Critical" sub-category in Oregon (Oregon Department of Fish and Wildlife 1995) and a species of special concern in Idaho (Idaho Department of Fish and Game 1994) and Washington (Washington Department of Wildlife 1996). In addition, the White-headed Woodpecker is considered a sensitive species by both the U.S. Forest Service (USFS) Northern and Intermountain Regions and the Bureau of Land Management (Blair and Servheen 1995). This species is considered at risk under land management alternatives proposed for the Interior Columbia River Basin (Lehmkuhl et al. 1997). In British Columbia the White-headed Woodpecker is listed as threatened by the Commission on the Status of Endangered Wildlife in Canada (Cannings 1995) and only about 100 pairs remain (Steeger et al. 1996). In an evaluation of conservation priorities for 243 species, the White-headed Woodpecker ranked among the top five priority species in the state of Idaho--only the Trumpeter Swan (*Cygnus buccinator*) and the Sage Grouse (*Centrocercus urophasianus*) ranked higher (Partners in Flight 1998).

Within this context, then, this study provides important information on White-headed Woodpeckers and their habitats as well as establishes a region-wide monitoring framework. My objectives were: (1) to determine the current distribution and abundance of White-headed Woodpeckers (*Picoides albolarvatus*) in the Interior Columbia River Basin Region using presence/absence and point count surveys; (2) to assess White-headed Woodpecker habitat relationships; (3) to map the distribution of White-headed Woodpeckers from point count surveys; and (4) to establish a region-wide monitoring program for White-headed Woodpeckers.

METHODS

MONITORING WORKSHOP

I developed a protocol for monitoring White-headed Woodpeckers and presented it in a workshop for organized agency personnel from Oregon, Idaho, and Washington to establish a consistent region-wide monitoring plan for White-headed Woodpeckers. This resulted in a higher number of transects conducted throughout the region by myself as well as by Tribal biologists, U.S. Forest Service personnel, state Fish and Wildlife agency personnel, and volunteers. As a result of this year's effort, and the establishment of numerous transects throughout the region, I anticipate that a baseline model for future monitoring of White-headed Woodpeckers (as well as other pine-associated species) is in place.

SAMPLING UNIT

Using a GIS system, 207 points were randomly generated from tracts of ponderosa pine forest types (at least 7 mi long and 1 mi wide) within the Interior Columbia River Basin (ICRB). Of these, I randomly selected 50 potential sites to survey personally; the rest of the sites were distributed accordingly to agency personnel and volunteers throughout the region. The latitude and longitude of each point was used to establish the starting point of each transect. All participants received a set of latitude and longitude coordinates for transects in their area, so as to establish a permanent transect on each site nearest the random point. Each participant completed as many transects as feasible, given time constraints and other professional commitments. The field protocol for this study was an adaptation of methods established by the USDA Forest Service Landbird Monitoring Project (Hutto and Hoffland 1996) as well as those of Ralph et al. (1995). Transects were located primarily on tertiary roads and then on secondary roads (Hutto et al. 1995, Ralph et al. 1995). When road access was unavailable or overly difficult, off-road censuses were conducted along trails and/or in open terrain. The sampling element was the transect of 10-15 points spaced at 0.5 mi. (0.8 km) intervals along the road. When a transect was walked, a hip-chain was used to measure distance between points. Each point was marked with an 18 inch wooden guard stake, rebar, or surveyor's flagging with the transect and point number.

I chose roadside monitoring because it increases the number of point counts that can be conducted within a specified period of time and this methodology also allows for the detection of silent, flying birds (Ralph et al. 1995). On tertiary roads, birds are counted in essentially the same proportions whether the point is on or off the road (Hutto et al.1995, Keller and Fuller 1995). Hutto et al. (1995) found that the probability of detecting Black-backed Woodpeckers is unrelated to the existence of roads, edges, or riparian cover types. My surveying experience--for woodpeckers in general and White-headed Woodpeckers specifically--corroborates these findings. Hutto et al. (1995) also recommend that sample points be stratified by habitat type encountered along the road. Therefore cover type, age class, and harvest/disturbance regime was recorded at each point count station.

POINT COUNTS

The protocol for point counts followed standardized methods for variable circular plots (Reynolds et al. 1980, Ralph et al.1995), but was modified to better census White-headed Woodpeckers. Point counts consisted of a 5-minute unsolicited and unlimited-distance point count followed by a 6-minute sequence of tape-playbacks. Data from the two types of counts were recorded separately--with a code--on a standardized field form. I used tape playback techniques because they increase the numbers of individuals detected and often allow the detection of problematic species (Johnson et al. 1981). And these techniques are applicable to species that may occur in low densities or species with large territories (Johnson et al. 1981) such as the White-headed Woodpecker. The playback technique is considered one of the best tools for avian censusing (Johnson et al. (1981).

Tape playback procedures essentially followed the Payette National Forest Protocol for Broadcast Vocalizations (Payette National Forest 1993). A sequence of three 30-second tape-playbacks of White-headed Woodpecker drums and calls were projected at 1-min. intervals using a Johnny Stewart™ game caller; that is, the first sequence of vocalizations was broadcast in a random direction (obtained from second-hand on watch). During the one minute pause after the first sequence, the game caller was rotated 120° for the second sequence, paused, then rotated another 120° for the final sequence of vocalizations, for a total of 6 minutes of tape-playbacks.

Ralph et al. (1995) advocate a larger number of statistically independent sampling stations over replication. Since the objectives of this study were to document the presence of White-headed Woodpeckers at a regional scale, each station was visited once. Counts were conducted from early April through mid-May when the detectability of White-headed Woodpeckers is highest and most stable. After this period the woodpeckers typically excavate from within the nest cavity and become less visible and less vocal. Counts began at official sunrise and typically ended by 11:00 a.m. All avian species detected, visual or auditory, were recorded. Surveys were not conducted during heavy rain, fog, or when wind, (greater than 20 mph) interfered with an observer's ability to detect calls.

The following header information was recorded at each point count station: Region, Forest, district, state, quad, transect, observer, date, time start, point, wind (calm, light, moderate, strong), sky conditions (clear, partly cloudy, mostly cloudy, overcast, foggy, lt. rain/drizzle), and temperature (°C). For each bird detected, the following information was recorded: species, horizontal distance from the point, interval (0-3 min., 3-5 min., 5-11 min.), detected outside of count period, seen, within target habitat type (late-successional/old-growth ponderosa pine), and flyover. I measured distance from the point to the bird with a Bushnell laser rangefinder.

HABITAT SAMPLING

At each point, visual estimates were recorded for cover type and structural stage (Appendices I and II). Classifications were based on the current stand structure. As originally conceived, when points were along a road, the observer walked off the road to conduct a 35.9-m radius plot within the representative habitat. After initial habitat measurement, I realized that using the semi-circle approach (as follows) not only eliminated the decision of where to place the plot, but also measured the vegetation on both sides of the road. Vegetation plot semi-circles began at the edge of the road pyramid. For counts of poles, small-medium, large, and extra-large trees within 11.3 m, seedlings and saplings (that formed a narrow hedgehog row along the road due to the light gap or road disturbance) were not counted (as per Hutto and Hoffland 1996). Dbh (diameter at breast height) tapes were used to classify trees into each of four dbh classes for stem counts. When points fell between two different cover types, both were recorded on the data sheet. Within a 35.9-m radius circular plot (0.4 ha) centered on each point, I recorded whether or not the point was on or within 100 m of road, slope (%), aspect (degrees), mean maximum canopy height (m), canopy closure (%), number of snags (≥ 25 cm dbh and >1.8 m tall), number of stumps (0.5-1.8 m tall), herb cover (%), shrub cover (%), cover type (Appendix I), and structural stage (Appendix II). Canopy height was measured with a clinometer and percent

canopy closure was measured using a spherical crown densiometer (Lemmon 1956, Strickler 1959). Within an 11.3-m-radius circular plot (0.04 ha), I counted the number of pole-sized trees (13-23 cm dbh), small-medium trees (23-53 cm dbh), large trees (53-79 cm dbh), and extra-large trees (>79 cm dbh).

Locations and elevations of the points were determined with Global Positioning Systems (GPS) when possible, otherwise they were determined from accurate topographic maps. I used PFINDER™ Software Version 2.53 to post-process differentially correct GPS rover files collected at each point. Because it was not always possible to download files, not all points were differentially corrected.

HABITAT CLASSIFICATION

Society of American Foresters (SAF) cover types (Appendix I) were combined with stand structure classes (Appendix II) to describe the habitat at each point. For analysis purposes, I classified the habitats encountered into 16 categories: old ponderosa pine, old ponderosa pine/Douglas-fir, old mixed-coniferous, mature ponderosa pine, mature ponderosa pine/Douglas-fir, mature mixed-coniferous, young ponderosa pine, young ponderosa pine/Douglas-fir, young mixed-coniferous, young lodgepole pine, stand initiation, understory reinitiation, open stem exclusion, closed stem exclusion, post-fire, and scablands (Table 1). Only old, mature, and young forests were subdivided into forest type. All harvest/disturbance categories were irrespective of forest type. Habitat data were summarized, tabulated, and used to identify patterns in bird species composition and abundance.

TABLE 1. Characteristics of habitat types at point counts in the Interior Columbia River Basin, 1998.

Habitat type	Structural characteristics
1. Old ponderosa pine	Ponderosa pine dominated multi-aged or single stratum stands with assortment of tree sizes and canopy strata present including large, old trees mostly >53 cm dbh. Grasses, forbs, and shrubs may be present.
2. Old ponderosa pine/Douglas-fir	Multi-aged or single stratum stands with an assortment of tree sizes and canopy strata present including large, old trees mostly >53 cm dbh. Ponderosa pine and Douglas-fir codominants.
3. Old mixed-coniferous	Multi-aged or single stratum stands with assortment of tree sizes and canopy strata present including large, old trees mostly >53 cm dbh and comprised of various combinations of ponderosa pine, sugar pine, grand fir/white fir, western larch, and Douglas-fir.
4. Mature ponderosa pine	Ponderosa pine dominated multi-storied stands with larger trees 30-53 cm dbh.
5. Mature ponderosa pine/Douglas-fir	Ponderosa pine/Douglas-fir dominated multi-storied stands with larger trees 30-53 cm dbh.
6. Mature mixed-coniferous	Multi-storied stands with larger trees 30-53 cm dbh, comprised of various combinations of ponderosa pine, sugar pine, Douglas-fir, grand fir/white fir, western larch, and subalpine fir.
7. Young ponderosa pine	Ponderosa pine dominated multi-aged stands with assortment of tree sizes (mostly 23-30 cm dbh) and canopy strata present, but very large trees absent. Grasses, forbs, and shrubs may be present.
8. Young ponderosa pine/Douglas-fir	Ponderosa pine and Douglas-fir dominated multi-aged stand with assortment of tree sizes (mostly 23-30 cm dbh) and canopy strata present but very large trees absent. Grasses, forbs, and shrubs may be present.

9. Young mixed-coniferous	Multi-aged stand with assortment of tree sizes (mostly 23-30 cm dbh) and canopy strata present but very large trees absent. Grasses, forbs, and shrubs may be present. May include various combinations of ponderosa pine, sugar pine, western larch, Douglas-fir, and grand fir/white fir.
10. Young lodgepole pine	Lodgepole pine dominated multi-aged stand with assortment of tree sizes (mostly 23-30 cm dbh) and canopy strata present, but very large trees absent. Grasses, forbs, and shrubs may be present.
11. Stand initiation	One canopy stratum (may be broken or continuous) and 1 cohort of seedlings or saplings. Grass, forbs, shrubs may also be present.
12. Understory reinitiation	Broken overstory canopy with formation of understory stratum and two or more cohorts. Overstory may be poles or larger trees; understory is seedlings, saplings, grasses, forbs, or shrubs. Two-storied. Includes all forest types.
13. Open stem exclusion	One broken canopy stratum which includes poles or smaller trees; grasses, shrubs or forbs may also be present. Includes all forest types.
14. Closed stem exclusion	Continuous closed canopy, usually one cohort; poles, small or medium trees present. Suppressed trees, grasses, shrubs, and forbs may be absent in some cover types. May include scattered residual old-growth that penetrates the main canopy. Includes all forest types.
15. Post-fire	Essentially the same as stand initiation, but there are numerous standing dead trees in the "natural" post-fire situation (e.g., Hutto and Hoffland 1996). Includes all forest types.
16. Scablands	Open areas characterized by thin rocky soils populated by drought-tolerant plants on gentle ridgetops (Johnson, Jr. and Simon 1987); may include grasses, shrubs, and scattered trees.

DATA ANALYSIS

I analyzed point count data using Program VCPS Version 1.3 (Copyright, E.O. Garton 1995), which incorporates the ordered distance method (Patil et al. 1982). Only detections from the first five minutes (intervals 1 and 2) of the point counts were used so as not to bias the estimate from detections obtained during the tape-playback period. Although many birds, especially woodpeckers, can be detected at distances well over 100 m, I used detections that occurred within 100 m of the observer in order to best represent the number of detections within a given habitat type at a point count. For those species with too few detections (to obtain a density estimate in Program VCPS) and for those with inflated densities due to excessively small effective areas, I calculated a density based on birds/count period output by Program VCPS and converted it to birds/40 ha based on a plot with a radius of 100 m (E. O. Garton pers. comm.).

I performed a one-way ANOVA--with density of birds/40 ha as the dependent variable and habitat type as the factor--to determine whether or not there was a difference in the density of birds across habitat types. I used SYSTAT version 7.0 (SPSS Inc. 1997) for all data analysis and implied statistical significance at $\alpha \leq 0.05$. Program ArcView was used to produce a distribution map from point data.

RESULTS

POINT COUNTS

This year's field effort spanned vast distances in three states (Oregon, Idaho, and Washington), 12 National Forests (Boise, Colville, Deschutes, Fremont, Malheur, Nez Perce, Ochoco, Okanogan, Payette, Umatilla, Wallowa-Whitman, and Wenatchee), three Tribal lands (Colville Confederated Tribes, Warm Springs Indian Reservation, and Yakama Indian Nation), as well as state and private lands within the Interior Columbia River Basin Region. A total of 545 points were surveyed between 10 April 1998 and 19 May 1998 on 54 transects (Table 2) with an average of 10 points per transect (range: 1-15). Two transects (7 points) were excluded from the analysis because they were not based on randomly generated locations. However, these points are included in the distribution map. No White-headed Woodpeckers were detected at either of the excluded transects. A total of 538 points were used in the analysis. Snow cover was present during many of the early counts and access was prohibitive at times.

A total of 104 bird species were detected during point counts and included 11 woodpecker species, 67 songbird species, 5 waterfowl species, 3 raptor species, 3 shorebird species, 4 gamebird species, 2 owl species, 2 hummingbird species, one kingfisher species, one gull species, one swift species, one nightjar species, one crane species, one dove species, and one rail species (Table 3).

Of the total detections during point counts ($n = 5135$), 26.3% were visual and 73.7 % were aural. The majority (58.4%) of detections occurred during the first three minutes, 18.3% during the next two minutes, and 23.3% during the tape-playback sequence ($n = 5138$). Unknown woodpeckers accounted for 1.4% of all detections ($n = 5138$). Most of these

Table 2. Locations and number of point counts conducted in each of 54 transects in the Interior Columbia River Basin, 1998.

Transect name	Latitude (N)	Longitude (W)	No. of Points
No. 802	46° 08' 20"	121° 00' 23"	13
No. 1742	46° 06' 56"	121° 01' 33"	15
No. 2555	46° 17' 23"	120° 53' 21"	15
Addy	48° 21' 00"	117° 50' 00"	10
Antoine Creek	47° 58' 09"	119° 58' 44"	1
Athol Ridge	47° 58' 53"	116° 47' 02"	8
Auger Creek	42° 57' 33"	121° 02' 43"	10
Bear Creek	44° 35' 30"	116° 59' 00"	10
Bear Gulch	44° 44' 01"	118° 09' 48"	10
Big Fir Spring	44° 05' 19"	120° 24' 24"	10
Bonneville Hot Springs	44° 10' 06"	115° 16' 55"	10
Canteen Flats	46° 54' 00"	120° 56' 00"	10
Catherine Creek	45° 05' 20"	117° 40' 10"	13
Coyote Creek	44° 57' 43"	121° 23' 41"	10
Dans Creek	44° 30' 00"	118° 35' 06"	10
Dark Canyon	44° 34' 05"	117° 46' 00"	1
Elk Spring	46° 12' 36"	117° 30' 00"	4
Fields Creek	44° 22' 42"	119° 18' 45"	11
Hay Creek	44° 24' 24"	120° 28' 06"	10
Kaiser Butte-143	46° 00' 52"	121° 56' 41"	15
Lane Creek	45° 15' 02"	118° 52' 03"	15
Lessig Road	48° 09' 00"	118° 03' 00"	10
Little Mud Spring	46° 14' 24"	117° 28' 00"	3
Little Rattlesnake	46° 46' 22"	120° 59' 48"	10
Lost Creek	43° 53' 13"	118° 57' 28"	10
McIntyre	45° 20' 40"	118° 27' 25"	10
McKay Creek	44° 28' 00"	120° 42' 50"	10
Middle Fork John Day	44° 39' 00"	118° 42' 00"	10
Mill Flat	42° 26' 27"	120° 24' 17"	9
Moffitt	43° 34' 48"	121° 24' 48"	15
Mud Springs	44° 18' 36"	119° 40' 20"	10
North Fork Wenas	46° 53' 48"	120° 48' 00"	10
Ninemile Ridge	45° 40' 06"	118° 05' 54"	6
Owen Butte	42° 20' 30"	120° 53' 00"	10
Owhi Flat	48° 12' 25"	118° 49' 23"	10
Porcupine Bay	47° 51' 10"	118° 09' 10"	10
Rabbit Creek	43° 49' 08"	115° 40' 53"	15
Red Gulch	44° 56' 41"	117° 24' 09"	10
Roaring River	43° 47' 19"	115° 26' 16"	10
Round Lake	42° 11' 23"	122° 00' 02"	10
Royce Mountain	43° 32' 42"	121° 53' 54"	15
Salmon Creek	48° 30' 53"	119° 47' 53"	10
Sawtooth Ridge	44° 58' 31"	117° 34' 40"	10
Silver Creek	45° 52' 05"	115° 47' 02"	10
Skunk Cabbage Flat	44° 44' 24"	116° 36' 48"	11
South Flat	42° 25' 22"	120° 38' 26"	10
Stephenson Mountain	44° 33' 45"	120° 31' 05"	10
Stevens Canyon	44° 20' 57"	121° 32' 04"	10
Strawberry Creek	44° 22' 46"	118° 39' 56"	10
Strawberry Spring	42° 04' 33"	120° 53' 07"	10
Swick Creek	44° 13' 17"	119° 01' 08"	10
Third Fork	44° 22' 30"	116° 18' 05"	10
Venator Creek	42° 04' 19"	120° 34' 13"	10
Wildcat	44° 25' 00"	120° 30' 00"	10

TABLE 3. Numbers of detections and percent of total detections for each bird species detected on point counts conducted in the Interior Columbia River Basin, 1998.

Species	Scientific name	No. individuals	Percent
Total		5007	100.00
Red Crossbill	*Loxia curvirostra*	402	8.03
Mountain Chickadee	*Parus gambeli*	396	7.91
Yellow-rumped Warbler	*Dendroica coronata*	363	7.25
American Robin	*Turdus migratorius*	349	6.97
Dark-eyed Junco	*Junco hyemalis*	307	6.13
Pine Siskin	*Carduelis pinus*	303	6.05
Red-breasted Nuthatch	*Sitta canadensis*	276	5.51
Chipping Sparrow	*Spizella passerina*	252	5.03
Northern Flicker	*Colaptes auratus*	240	4.79
Steller's Jay	*Cyanocitta stelleri*	134	2.68
Cassin's Finch	*Carpodacus cassinii*	129	2.58
Townsend's Solitaire	*Myadestes townsendi*	126	2.52
Williamson's Sapsucker	*Sphyrapicus thyroideus*	88	1.76
Dusky Flycatcher	*Empidonax oberholseri*	86	1.72
Hairy Woodpecker	*Picoides villosus*	81	1.62
Evening Grosbeak	*Coccothraustes vespertinus*	78	1.56
Golden-crowned Kinglet	*Regulus satrapa*	74	1.48
Brown-headed Cowbird	*Molothrus ater*	70	1.40
Spotted Towhee	*Pipilo erythrophthalmus*	70	1.40
Common Raven	*Corvus corax*	66	1.32
Red-naped Sapsucker	*Sphyrapicus nuchalis*	65	1.30
White-breasted Nuthatch	*Sitta carolinensis*	61	1.22
White-headed Woodpecker	*Picoides albolarvatus*	53	1.06
Pileated Woodpecker	*Dryocopus pileatus*	43	0.86
Red-winged Blackbird	*Agelaius phoeniceus*	41	0.82
Canada Goose	*Branta canadensis*	37	0.74
Ruby-crowned Kinglet	*Regulus calendula*	37	0.74
Solitary Vireo	*Vireo solitarius*	34	0.68
Hammond's Flycatcher	*Empidonax hammondii*	33	0.66
Brown Creeper	*Certhia americana*	32	0.64
House Wren	*Troglodytes aedon*	32	0.64
Ruffed Grouse	*Bonasa umbellus*	32	0.64
Western Tanager	*Piranga ludoviciana*	29	0.58
Black-capped Chickadee	*Parus atricapillus*	27	0.54
Clark's Nutcracker	*Nucifraga columbiana*	27	0.54
Song Sparrow	*Melospiza melodia*	27	0.54
Nashville Warbler	*Vermivora ruficapilla*	26	0.52
Orange-crowned Warbler	*Vermivora celata*	25	0.50
Pygmy Nuthatch	*Sitta pygmaea*	23	0.46
Western Bluebird	*Sialia mexicana*	23	0.46
Violet-green Swallow	*Tachycineta thalassina*	21	0.42
Mallard	*Anas platyrhynchos*	19	0.38
Western Meadowlark	*Sturnella neglecta*	19	0.38
Gray Jay	*Perisoreus canadensis*	18	0.36
Townsend's Warbler	*Dendroica townsendi*	18	0.36
Blue Grouse	*Dendragapus obscurus*	16	0.32
Gray Flycatcher	*Empidonax wrightii*	16	0.32
Vaux's Swift	*Chaetura vauxi*	16	0.32
Common Snipe	*Gallinago gallinago*	15	0.30
American Kestrel	*Falco sparverius*	14	0.28
Hermit Thrush	*Catharus guttatus*	13	0.26
Mourning Dove	*Zenaida macroura*	13	0.26
Red-tailed Hawk	*Buteo jamaicensis*	12	0.24
Yellow Warbler	*Dendroica petechia*	12	0.24
Fox Sparrow	*Passerella iliaca*	11	0.22
MacGillivray's Warbler	*Oporornis tolmiei*	11	0.22
Winter Wren	*Troglodytes troglodytes*	11	0.22
Mountain Bluebird	*Sialia currucoides*	10	0.20
Ring-necked Duck	*Aythya collaris*	10	0.20
Varied Thrush	*Ixoreus naevius*	10	0.20

Warbling Vireo	*Vireo gilvus*	10	0.20
Black-throated Gray Warbler	*Dendroica nigrescens*	9	0.18
Tree Swallow	*Tachycineta bicolor*	6	0.12
Wilson's Warbler	*Wilsonia pusilla*	6	0.12
Black-backed Woodpecker	*Picoides arcticus*	5	0.10
Belted Kingfisher	*Ceryle alcyon*	5	0.10
Brewer's Blackbird	*Euphagus cyanocephalus*	5	0.10
California Quail	*Callipepla californica*	5	0.10
Killdeer	*Charadrius vociferus*	5	0.10
Swainson's Thrush	*Catharus minimus*	5	0.10
European Starling	*Sturnus vulgaris*	4	0.08
Lincoln's Sparrow	*Melospiza lincolnii*	4	0.08
Turkey Vulture	*Cathartes aura*	4	0.08
Vesper Sparrow	*Pooecetes gramineus*	4	0.08
American Crow	*Corvus brachyrhyncos*	3	0.06
Black-billed Magpie	*Pica pica*	3	0.06
Black-headed Grosbeak	*Pheucticus melanocephalus*	3	0.06
Bufflehead	*Bucephala albeola*	3	0.06
Wild Turkey	*Meleagris gallopavo*	3	0.06
American Green-winged Teal	*Anas crecca*	2	0.04
American Dipper	*Cinclus mexicanus*	2	0.04
Calliope Hummingbird	*Stellula calliope*	2	0.04
Lazuli Bunting	*Passerina amoena*	2	0.04
Red-breasted Sapsucker	*Sphyrapicus ruber*	2	0.04
Rufous Hummingbird	*Selasphorus rufus*	2	0.04
White-crowned Sparrow	*Zonotrichia leucophrys*	2	0.04
Western Wood-Pewee	*Contopus sordidulus*	2	0.04
American Goldfinch	*Carduelis tristis*	1	0.02
Cordilleran Flycatcher	*Empidonax occidentalis*	1	0.02
Common Nighthawk	*Chordeiles minor*	1	0.02
Canyon Wren	*Catherpes mexicanus*	1	0.02
Downy Woodpecker	*Picoides pubescens*	1	0.02
Great-horned Owl	*Bubo virginianus*	1	0.02
Grasshopper Sparrow	*Ammodramus savannarum*	1	0.02
Green-tailed Towhee	*Pipilo chlorurus*	1	0.02
Horned Lark	*Eremophila alpestris*	1	0.02
Lark Sparrow	*Chondestes grammacus*	1	0.02
Lewis' Woodpecker	*Melanerpes lewis*	1	0.02
Northern Pygmy-Owl	*Glaucidium gnoma*	1	0.02
Ring-billed Gull	*Larus delawarensis*	1	0.02
Sandhill Crane	*Grus canadensis*	1	0.02
Sora	*Porzana carolina*	1	0.02
Spotted Sandpiper	*Actitis mascularia*	1	0.02
Three-toed Woodpecker	*Picoides tridactylus*	1	0.02

observations were drumming birds and observers were not able to distinguish to species by call or by sight.

The five most abundant woodpecker species detected during point counts were the Northern Flicker, Williamson's Sapsucker, Hairy Woodpecker, Red-naped Sapsucker, and White-headed Woodpecker. Five Black-backed Woodpeckers were detected, none of which occurred in post-fire habitat types. Two additional Black-backed Woodpeckers were detected outside the count period. Observations for this species occurred in ponderosa pine closed stem exclusion, old mixed-coniferous, mixed-coniferous open stem exclusion, ponderosa pine understory reinitiation, and ponderosa pine/Douglas-fir understory reinitiation habitat types.

The total density for all species ranged from 4.33 birds/40 ha in young ponderosa pine/Douglas-fir to 480.34 birds/40 ha in understory reinitiations (Table 4). I excluded post-fire (n = 4 points), scablands (n = 5 points), young lodgepole pine (n = 1 points), and young ponderosa pine/Douglas-fir (n = 6 points) habitat types from the analysis because there were so few points in each type. The resulting analysis of variance testing for differences in density of birds/40 ha among habitat types was not significant (ANOVA, $F_{11, 1272} = 1.482$, $P = 0.132$). Habitat composition at point count stations is summarized in Table 5.

Species richness by habitat type varied from one to 53 species (Table 4). Species richness was lowest in young lodgepole pine and greatest in mature ponderosa pine. The four lowest species richness values corresponded to the four habitat types with the fewest number of points: young lodgepole pine, young ponderosa pine/Douglas-fir, scablands, and post-fire. If these four habitat types are disregarded, the next lowest species richness occurred in open stem exclusions.

In addition to those species detected during point counts, I observed an American White Pelican (*Pelecanus erythrorhynchos*) flying over a habitat plot on the Venator Creek Transect on the Lakeview District of the Fremont National Forest in south-eastern Oregon. I observed an Eastern Kingbird (*Tyrannus tyrannus*) and two Western Kingbirds (*Tyrannus verticalis*) between point counts on the Porcupine Bay Transect near the Coulee Dam National Recreation Area in east-central Washington. While camping in Washington Creek in central Washington on the night of May 15, 1998, and early in the morning of May 16 (before conducting one point count at Antoine Creek), I heard a Long-eared Owl (*Asio otus*) hooting and a Common Poorwill (*Phalaenoptilus nuttallii*) calling.

WHITE-HEADED WOODPECKER DENSITY AND DISTRIBUTION

A total of 76 White-headed Woodpeckers were observed on 29 transects (59 points) (Table 6; Figure 1). Of those White-headed Woodpeckers detected during point counts, 27 (50.9%) were detected during the first 3 minutes, 5 (9.4%) were detected in the next two minutes, and 21 (39.6%) were detected during the tape-playback sequence (n = 53). For the density analysis, distances were truncated at 100 m to allow for habitat associations. This reduced the number of White-headed Woodpecker detections to 22 for birds that were detected in the first five minutes within 100 m of the observer. Detection distances for White-headed Woodpeckers averaged 77.577 ± 4.958 m SE (n = 52; range: 16-189 m) during all intervals.

TABLE 4. Densities (birds/40 ha) of bird species detected during 5-minute point counts in the Interior Columbia River Basin, 1998. Data truncated at 100 m.

	Habitat type[a]															
Species	O. pp	O. pp/Df	O. mc	M. pp	M. pp/Df	M. mc	Y. pp	Y. pp/D	Y. mc	Y. lp	Si	Ur	Seo	Sec	Pf	Scab
American Dipper	—	—	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—
American Goldfinch	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	—	—
American Green-winged Teal	—	—	—	—	—	—	—	—	—	—	—	0.25	—	—	—	—
American Kestrel	0.13	—	—	0.84	—	—	—	—	—	—	0.89	—	—	—	—	—
American Robin	10.08	5.36	6.92	28.56	41.92	7.51	6.12	—	91.56	—	7.64	14.88	3.06	5.48	—	2.55
Belted Kingfisher	—	—	—	—	1.27	—	—	—	—	—	—	—	—	—	—	—
Black-backed Woodpecker	—	—	—	—	—	—	—	—	—	—	—	0.13	0.76	—	—	—
Black-billed Magpie	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	—	—
Black-capped Chickadee	—	—	—	7.48	—	—	3.16	—	1.12	—	—	—	—	—	—	—
Black-headed Grosbeak	—	—	—	—	—	—	—	—	—	—	—	2.36	—	—	—	—
Black-throated Gray Warbler	1.20	—	—	—	10.48	—	—	—	—	—	—	—	—	—	—	—
Blue Grouse	—	—	—	—	—	—	0.38	—	—	—	—	—	—	—	—	—
Brewer's Blackbird	—	—	—	—	—	—	—	—	0.51	—	—	—	—	—	—	—
Brown-headed Cowbird	0.60	—	—	2.64	—	0.51	3.32	—	—	—	0.89	6.88	0.76	0.96	—	—
Brown Creeper	5.44	—	0.38	1.76	1.27	—	0.38	—	0.51	—	—	7.68	—	—	—	—
Bufflehead	—	—	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—
California Quail	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	—	—
Cassin's Finch	10.00	0.64	28.60	1.64	—	1.32	2.55	—	6.56	—	—	6.88	—	2.04	—	—
Chipping Sparrow	3.04	2.36	3.56	11.12	1.27	8.32	4.00	—	16.72	—	1.66	77.08	3.06	9.80	3.18	—
Clark's Nutcracker	—	—	3.92	—	—	—	0.25	—	0.51	—	—	—	—	—	—	—
Common Raven	—	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—
Common Snipe	—	—	—	2.20	—	—	—	—	—	—	—	—	—	—	—	—
Dark-eyed Junco	17.44	66.92	22.12	5.98	1.27	7.51	37.92	—	39.88	25.46	119.52	56.96	55.52	16.92	3.18	3.84
Downy Woodpecker	—	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—
Dusky Flycatcher	0.80	0.92	0.38	2.92	1.27	9.00	8.16	—	1.15	—	0.89	27.32	—	0.25	—	—
Evening Grosbeak	—	—	8.72	—	—	0.25	—	—	—	—	—	4.08	—	—	—	—
Fox Sparrow	—	—	—	0.38	—	0.25	—	—	—	—	0.89	0.25	—	—	—	—
Golden-crowned Kinglet	3.36	0.64	7.16	0.38	94.36	5.00	0.38	—	34.64	—	—	45.12	—	0.25	—	2.55
Gray Flycatcher	—	—	—	1.56	—	—	0.88	—	—	—	—	0.13	—	1.72	—	—

Species	O. pp	O. pp/Df	O. mc	M. pp	M. pp/Df	M. mc	Y. pp	Y. pp/D	Y. mc	Y. lp	Si	Ur	Seo	Sec	Pf	Scab
Gray Jay	—	—	—	0.25	—	0.25	—	—	2.56	—	—	0.13	—	9.20	—	—
Great-horned Owl	—	—	0.38	—	—	—	—	—	—	—	—	—	—	—	—	—
Green-tailed Towhee	0.13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Hairy Woodpecker	3.20	0.64	7.16	2.12	—	0.52	0.25	2.16	0.52	—	0.89	3.04	0.76	1.15	—	—
Hammond's Flycatcher	0.56	0.64	0.60	1.20	20.88	0.84	—	—	0.51	—	—	—	—	—	—	—
Hermit Thrush	0.13	—	—	—	1.27	—	—	—	1.15	—	—	0.13	—	0.25	—	—
Horned Lark	—	—	—	—	—	—	—	—	—	—	—	0.13	—	—	—	—
House Wren	5.28	0.64	0.76	1.28	—	0.25	1.20	—	0.51	—	—	0.51	—	3.36	6.37	—
Killdeer	—	—	—	0.25	—	0.51	0.25	—	—	—	—	—	—	—	—	—
Lark Sparrow	—	—	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—
Lazuli Bunting	—	—	—	—	—	—	0.25	—	—	—	—	—	—	—	—	—
Lincoln's Sparrow	—	0.64	0.38	—	—	0.25	—	—	—	—	—	0.13	—	—	—	—
MacGillivray's Warbler	0.13	0.64	1.40	1.76	—	0.25	—	—	—	—	—	—	—	—	—	—
Mallard	0.13	—	—	—	—	1.16	—	—	—	—	—	—	—	—	—	—
Mountain Bluebird	—	19.96	—	0.25	—	—	3.92	—	—	—	—	—	—	—	—	—
Mountain Chickadee	20.32	12.72	16.48	14.32	7.56	7.77	27.08	—	51.12	—	1.64	25.08	24.36	26.44	3.18	—
Mourning Dove	—	—	—	0.76	—	0.51	—	—	—	—	—	—	—	0.24	—	—
Nashville Warbler	—	0.64	0.38	0.25	—	—	0.25	—	—	—	—	16.80	—	—	—	—
Northern Flicker	2.92	0.96	3.06	8.84	—	1.04	1.66	2.16	2.56	—	2.55	2.88	4.20	5.84	3.18	—
Orange-crowned Warbler	—	1.80	2.32	1.88	—	0.25	0.25	—	0.51	—	—	0.72	—	0.25	—	—
Pileated Woodpecker	1.24	—	1.16	0.25	—	0.25	—	—	0.51	—	1.66	—	0.88	—	—	—
Pine Siskin	4.92	4.08	8.15	2.16	—	19.00	5.24	—	0.84	—	0.76	0.44	0.76	4.58	—	—
Pygmy Nuthatch	2.88	—	—	0.76	—	—	0.25	—	—	—	—	—	—	8.64	—	—
Red-breasted Nuthatch	2.40	11.52	16.16	5.92	21.60	8.68	2.24	—	9.42	—	2.55	12.92	6.60	3.44	—	—
Red-breasted Sapsucker	0.13	—	—	—	—	—	—	—	—	—	—	—	—	0.25	—	—
Red-naped Sapsucker	0.13	—	0.38	—	—	4.16	0.25	—	1.15	—	0.89	—	0.76	0.25	—	2.55
Red-tailed Hawk	—	—	—	—	—	—	—	—	—	—	0.89	—	—	—	—	—
Red-winged Blackbird	0.13	—	—	14.64	—	—	2.52	—	2.56	—	—	0.64	—	0.25	—	—
Red Crossbill	6.28	0.64	0.76	0.25	—	2.96	2.76	—	1.76	—	—	0.25	—	0.51	—	—
Ruby-crowned Kinglet	0.25	—	—	0.52	—	4.48	1.76	—	—	—	0.89	6.24	0.76	0.51	—	—
Ruffed Grouse	0.84	—	3.40	1.48	1.27	3.20	—	—	1.15	—	0.89	0.84	—	—	—	—
Rufous Hummingbird	4.92	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Solitary Vireo	1.24	—	0.38	1.00	11.20	0.51	0.25	—	6.36	—	—	4.68	—	—	—	—
Song Sparrow	0.25	2.20	—	4.96	1.27	0.76	0.68	—	—	—	—	—	—	—	—	—

Species	O. pp	O. pp/Df	O. mc	M. pp	M. pp/Df	M. mc	Y. pp	Y. pp/D	Y. mc	Y. lp	Si	Ur	Seo	Sec	Pf	Scab
Spotted Sandpiper	—	—	—	0.25	—	—	—	—	—	—	—	—	—	—	—	—
Spotted Towhee	1.32	0.64	—	3.92	—	0.51	8.52	—	10.24	—	4.84	7.36	—	0.84	—	—
Steller's Jay	1.60	—	5.44	2.04	1.27	4.76	1.27	—	3.00	—	1.66	3.96	0.76	0.64	—	—
Swainson's Thrush	—	—	—	0.25	—	—	0.25	—	—	—	—	—	—	—	—	—
Three-toed Woodpecker	—	—	—	—	—	—	—	—	—	—	—	0.13	—	—	—	—
Townsend's Solitaire	0.64	0.72	1.15	1.60	—	0.76	3.20	—	—	—	0.89	9.08	1.53	3.76	—	—
Townsend's Warbler	—	0.64	0.96	—	—	2.04	—	—	18.24	—	—	0.13	—	—	—	—
Tree Swallow	—	—	—	—	—	—	—	—	—	—	—	0.44	—	—	—	—
Varied Thrush	—	—	—	0.25	—	0.25	—	—	—	—	—	—	—	—	—	—
Vesper Sparrow	0.13	—	—	—	—	—	—	—	—	—	—	0.13	—	0.25	—	—
Violet-green Swallow	—	—	—	0.25	—	—	0.25	—	—	—	—	0.89	—	—	—	—
Warbling Vireo	—	—	—	—	—	—	—	—	—	—	—	1.24	—	—	—	—
Western Bluebird	11.12	—	—	1.00	—	0.25	—	—	0.51	—	1.66	1.24	—	—	—	—
Western Meadowlark	0.13	—	—	0.38	—	—	0.60	—	—	—	—	0.13	—	0.25	—	—
Western Tanager	0.92	0.64	0.44	0.25	—	0.76	1.76	—	0.51	—	—	2.12	—	0.25	—	—
Western Wood-Pewee	—	—	—	0.25	—	—	0.25	—	—	—	—	—	—	—	—	—
White-breasted Nuthatch	0.80	—	3.16	0.76	—	0.25	0.64	—	—	—	—	3.56	—	2.52	3.18	—
White-crowned Sparrow	—	0.64	—	—	—	—	—	—	—	—	—	0.13	—	—	—	—
White-headed Woodpecker	1.08	—	5.36	0.72	—	0.25	0.38	—	0.51	—	—	0.13	—	0.25	—	—
Wild Turkey	—	—	—	—	—	—	—	—	—	—	—	0.13	—	—	—	—
Williamson's Sapsucker	2.12	—	1.15	—	—	0.76	0.84	—	—	—	—	—	—	3.96	—	—
Wilson's Warbler	0.13	—	—	—	—	—	0.25	—	—	—	—	0.13	—	—	—	—
Winter Wren	0.13	—	0.76	—	—	—	—	—	0.51	—	0.89	1.80	—	—	—	—
Yellow-rumped Warbler	7.72	19.08	4.72	6.62	101.52	41.04	56.68	—	24.68	—	2.44	122.08	13.88	11.84	—	—
Yellow Warbler	0.13	—	—	1.00	1.27	—	1.48	—	—	—	0.89	—	—	—	—	—
Total density	138.44	156.88	168.60	152.93	322.25	149.22	195.75	4.33	334.53	25.46	159.25	480.34	118.43	127.19	22.28	11.48
Total number of species	46	26	36	53	18	42	47	2	34	1	24	50	16	34	6	4
No. of points	85	21	33	60	10	51	60	6	23	1	15	84	17	45	4	5

[a] O. pp = Old ponderosa pine; O. pp/Df = Old ponderosa pine/Douglas-fir; O. mc = Old mixed-coniferous; M. pp = Mature ponderosa pine; M. pp/Df = Mature ponderosa pine/Douglas-fir; M. mc = Mature mixed-coniferous; Y. pp = Young ponderosa pine; Y. pp/Df = Young ponderosa pine/Douglas-fir; Y. mc = Young mixed-coniferous; Y. lp = Young lodgepole pine; Si = Stand initiation; Ur = Understory reinitiation; Seo = Open stem exclusion; Sec = Closed stem exclusion; Pf = Post-fire; Scab = Scablands.

TABLE 5. Habitat characteristics ($\bar{x}$ ± SE, with *n* in parentheses) at point count stations surveyed during 1998 in the Interior Columbia River Basin.

Habitat type	Slope (%)	Canopy ht. (m)	Canopy cover (%)	Snags	Stumps
Old ponderosa pine	14.952 ± 1.594 (83)	22.638 ± 1.037 (80)	39.831 ± 2.334 (83)	1.048 ± 0.192 (84)	3.952 ± 0.674 (84)
Old ponderosa pine/Douglas-fir	19.909 ± 3.121 (22)	26.409 ± 2.240 (22)	48.045 ± 4.301 (22)	1.136 ± 0.768 (22)	0.591 ± 0.252 (22)
Old mixed-coniferous	13.212 ± 2.048 (33)	27.656 ± 1.824 (32)	46.182 ± 3.823 (33)	0.576 ± 0.157 (33)	2.667 ± 1.117 (33)
Mature ponderosa pine	19.361 ± 2.127 (61)	22.639 ± 1.233 (61)	42.164 ± 3.197 (61)	1.082 ± 0.266 (61)	2.852 ± 0.767 (61)
Mature ponderosa pine/Douglas-fir	13.222 ± 5.041 (9)	14.200 ± 2.847 (10)	37.400 ± 7.503 (10)	0.300 ± 0.213 (10)	3.400 ± 1.470 (10)
Mature mixed-coniferous	16.532 ± 2.476 (47)	26.128 ± 1.566 (47)	45.383 ± 2.968 (47)	1.213 ± 0.292 (47)	1.261 ± 0.356 (46)
Young ponderosa pine	15.847 ± 1.992 (59)	25.200 ± 1.053 (60)	46.717 ± 3.200 (60)	1.067 ± 0.303 (60)	6.567 ± 1.328 (60)
Young ponderosa pine/Douglas-fir	11.167 ± 2.937 (6)	27.167 ± 3.103 (6)	49.833 ± 8.841 (6)	0.500 ± 0.224 (6)	0.000 ± 0.000 (6)
Young mixed-coniferous	18.593 ± 1.654 (27)	28.556 ± 1.922 (27)	45.407 ± 3.839 (27)	1.481 ± 0.390 (27)	4.630 ± 1.615 (27)
Young lodgepole pine	30.000 ± 0.000 (1)	27.000 ± 0.000 (1)	45.000 ± 0.000 (1)	3.000 ± 0.000 (1)	25.000 ± 0.000 (1)
Stand initiation	21.333 ± 5.206 (15)	27.267 ± 1.747 (15)	40.733 ± 5.409 (15)	1.133 ± 0.256 (15)	4.200 ± 2.738 (15)
Understory reinitiation	14.286 ± 1.658 (77)	26.571 ± 1.161 (77)	44.688 ± 2.874 (77)	1.000 ± 0.378 (77)	1.571 ± 0.727 (77)
Open stem exclusion	12.063 ± 2.387 (16)	27.750 ± 2.709 (16)	47.750 ± 6.006 (16)	0.937 ± 0.266 (16)	3.938 ± 1.697 (16)
Closed stem exclusion	12.733 ± 2.132 (45)	26.705 ± 1.306 (44)	39.867 ± 3.441 (45)	1.733 ± 0.366 (45)	1.333 ± 0.440 (45)
Post-fire	24.750 ± 5.558 (4)	26.250 ± 3.250 (4)	27.500 ± 7.773 (4)	0.250 ± 0.250 (4)	19.750 ± 7.663 (4)
Scablands	25.000 ± 4.564 (4)	27.000 ± 3.109 (4)	59.500 ± 8.578 (4)	0.250 ± 0.250 (4)	0.000 ± 0.000 (4)

TABLE 5. (continued) Habitat characteristics ($\bar{x} \pm$ SE, with *n* in parentheses) at point count stations surveyed during 1998 in the Interior Columbia River Basin.

Habitat type	Herb cover (%)	Shrub cover (%)	Poles[a]	Small-medium[a]	Large[a]
Old ponderosa pine	45.301 ± 3.897 (83)	19.131 ± 1.781 (84)	4.917 ± 0.480 (84)	4.226 ± 0.477 (84)	0.869 ± 0.130 (84)
Old ponderosa pine/Douglas-fir	45.273 ± 7.183 (22)	19.682 ± 3.268 (22)	4.364 ± 1.127 (22)	3.773 ± 0.624 (22)	0.455 ± 0.157 (22)
Old mixed-coniferous	50.545 ± 6.079 (33)	19.061 ± 3.327 (33)	5.697 ± 1.386 (33)	6.030 ± 1.490 (33)	0.848 ± 0.227 (33)
Mature ponderosa pine	41.131 ± 3.400 (61)	21.350 ± 2.645 (60)	4.164 ± 0.588 (61)	4.377 ± 0.517 (61)	0.574 ± 0.125 (61)
Mature ponderosa pine/Douglas-fir	42.500 ± 10.833 (10)	31.700 ± 10.009 (10)	3.500 ± 1.014 (10)	4.200 ± 1.665 (10)	0.300 ± 0.300 (10)
Mature mixed-coniferous	50.457 ± 3.907 (46)	28.383 ± 3.911 (47)	5.894 ± 0.949 (47)	4.638 ± 0.824 (47)	1.000 ± 0.209 (47)
Young ponderosa pine	52.931 ± 3.917 (58)	19.250 ± 2.492 (60)	3.700 ± 0.514 (60)	3.900 ± 0.512 (60)	1.017± 0.188 (60)
Young ponderosa pine/Douglas-fir	11.333 ± 3.471 (6)	13.000 ± 1.844 (6)	5.500 ± 2.172 (6)	4.333 ± 1.430 (6)	0.500 ± 0.224 (6)
Young mixed-coniferous	30.852 ± 5.412 (27)	15.889 ± 3.312 (27)	5.074 ± 1.369 (27)	3.704 ± 0.610 (27)	0.889 ± 0.252 (27)
Young lodgepole pine	20.000 ± 0.000 (1)	5.000 ± 0.000 (1)	10.000 ± 0.000 (1)	3.000 ± 0.000 (1)	0.000 ± 0.000 (1)
Stand initiation	60.933 ± 7.428 (15)	34.667 ± 7.294 (15)	3.067 ± 1.263 (15)	2.467 ± 0.542 (15)	1.133 ± 0.336 (15)
Understory reinitiation	39.814 ± 4.167 (59)	11.195 ± 1.717 (77)	3.338 ± 0.380 (77)	3.870 ± 0.372 (77)	0.701 ± 0.125 (77)
Open stem exclusion	38.812 ± 8.323 (16)	14.063 ± 3.422 (16)	3.688 ± 0.879 (16)	3.688 ± 0.734 (16)	1.063 ± 0.266 (16)
Closed stem exclusion	58.632 ± 5.120 (38)	20.429 ± 3.438 (42)	3.778 ± 0.600 (45)	4.067 ± 0.550 (45)	0.733 ± 0.147 (45)
Post-fire	53.750 ± 12.809 (4)	10.750 ± 2.839 (4)	4.750 ± 1.974 (4)	4.500 ± 1.893 (4)	0.500 ± 0.289 (4)
Scablands	56.250 ± 8.004 (4)	28.250 ± 9.647 (4)	3.000 ± 1.472 (4)	7.000 ± 2.082 (4)	1.250 ± 0.946 (4)

[a] number of trees in each size class

TABLE 5. (continued) Habitat characteristics ($\bar{x} \pm$ SE, with *n* in parentheses) at point count stations surveyed during 1998 in the Interior Columbia River Basin.

Habitat type	Extra-large[a]
Old ponderosa pine	0.131 ± 0.056 (84)
Old ponderosa pine/Douglas-fir	0.045 ± 0.045 (22)
Old mixed-coniferous	0.030 ± 0.030 (33)
Mature ponderosa pine	0.148 ± 0.065 (61)
Mature ponderosa pine/Douglas-fir	0.000 ± 0.000 (10)
Mature mixed-coniferous	0.213 ± 0.086 (47)
Young ponderosa pine	0.083 ± 0.036 (60)
Young ponderosa pine/Douglas-fir	0.667 ± 0.494 (6)
Young mixed-coniferous	0.333 ± 0.119 (27)
Young lodgepole pine	0.000 ± 0.000 (1)
Stand initiation	0.133 ± 0.091 (15)
Understory reinitiation	0.169 ± 0.054 (77)
Open stem exclusion	0.125 ± 0.085 (16)
Closed stem exclusion	0.111 ± 0.057 (45)
Post-fire	0.000 ± 0.000 (4)
Scablands	0.000 ± 0.000 (4)

[a] number of trees in each size class

TABLE 6. White-headed Woodpeckers detected on survey routes in the Interior Columbia River Basin, 1998.

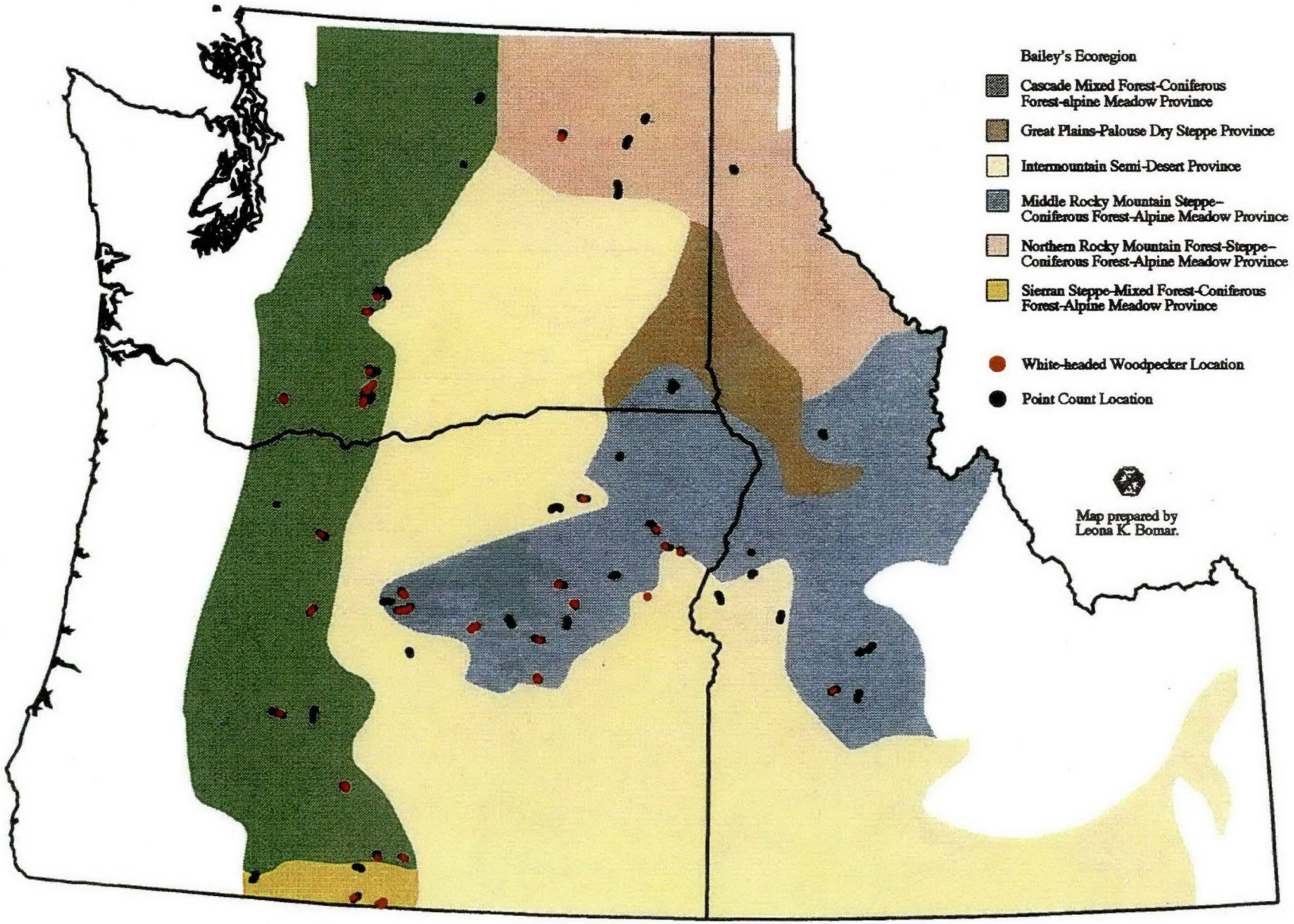
State/Forest/Transect	Point	Date	Latitude (°N)	Longitude (°W)	Elev. (m)	Observer	Observation
Idaho							
Boise National Forest							
Rabbit Creek	07	05/19/98	43.81	115.72	1681	V. A. Saab	single, calling
Oregon							
Deschutes National Forest							
Royce Mtn.	12	05/14/98	43.53	121.80	1495	T. P. Gawronski	pair, calling
Stevens Canyon	03	04/15/98	44.36	121.52	954	R. D. Dixon	single, calling
Stevens Canyon	05	04/15/98	44.37	121.51	963	R. D. Dixon	single, calling
Stevens Canyon	07	04/15/98	44.38	121.50	928	R. D. Dixon	single, calling
Fremont National Forest							
Auger Creek	02	04/25/98	42.96	121.04	1638	R. D. Dixon	3 birds, calling and foraging
Auger Creek	05	04/25/98	42.98	121.03	1688	R. D. Dixon	male, drumming and calling
Auger Creek	07	04/25/98	42.99	121.05	1617	R. D. Dixon	pair, calling and drumming
Mill Flat	03	04/23/98	42.44	120.39	1446	R. D. Dixon	pair, calling and foraging
Mill Flat	08	04/23/98	42.43	120.36	1585	R. D. Dixon	single
Mill Flat	08	04/23/98	42.43	120.36	1585	R. D. Dixon	single, drumming
Mill Flat	08	04/23/98	42.43	120.36	1585	R. D. Dixon	single
South Flat	02	05/06/98	42.43	120.65	1622	R. W. Ghormley	single
Strawberry Spring		04/22/98	42.09	120.89	1689	R. D. Dixon	male
Venator Creek	01	04/24/98	42.07	120.57	1610	R. D. Dixon	male, calling
Venator Creek	05	04/24/98	42.05	120.57	1664	R. D. Dixon	single, calling
Venator Creek	07	04/24/98	42.04	120.59	1722	R. D. Dixon	single, calling
Venator Creek	10	04/24/98	42.05	120.61	1693	R. D. Dixon	single, calling
Malheur National Forest							
Dans Creek	01	06/11/98	44.50	118.59	1550	L. Y. Cobb	female
Dans Creek	02	05/07/98	44.51	118.59	1550	L. Y. Cobb	single
Dans Creek	02	05/07/98	44.51	118.59	1550	L. Y. Cobb	single
Dans Creek	04	05/07/98	44.51	118.57	1650	L. Y. Cobb	female
Dans Creek	04	05/07/98	44.51	118.57	1650	L. Y. Cobb	single
Dans Creek	05	06/11/98	44.50	118.57	1540	L. Y. Cobb	single, calling
Lost Creek	06	04/26/98	43.89	118.98	1568	R. D. Dixon	pair, calling and drumming
Lost Creek	08	04/26/98	43.90	118.98	1584	R. D. Dixon	single, calling

Lost Creek	10	04/26/98	43.91	118.99	1493	R. D. Dixon	male, calling and drumming
Middle Fork John Day	10	05/08/98	44.66	118.77	1340	L. Y. Cobb	pair, excavating
Swick Creek	07	05/03/98	44.21	118.97	1579	R. D. Dixon	single, calling
Ochoco National Forest							
Hay Creek	01	05/11/98	44.41	120.47	1302	T. K. Bryan	single
Hay Creek	05	05/11/98	44.42	120.44	1409	T. K. Bryan	single
Hay Creek	07	05/11/98	44.43	120.42	1430	T. K. Bryan	single
Mud Springs	02	05/01/98	44.31	119.67	1767	R. D. Dixon	female, calling
Mud Springs	02	05/01/98	44.31	119.67	1767	R. D. Dixon	male
Mud Springs	05	05/01/98	44.30	119.69	1368	R. D. Dixon	single, calling
Mud Springs	10	05/01/98	44.28	119.73	1509	R. D. Dixon	pair, calling
Stephenson Mountain	06	04/30/98	44.54	120.51	1470	R. D. Dixon	male, foraging
Stephenson Mountain	08	04/30/98	44.54	120.49	1505	R. D. Dixon	single
Stephenson Mountain	08	04/30/98	44.54	120.49	1505	R. D. Dixon	single
Stephenson Mountain	10	04/30/98	44.53	120.49	1432	R. D. Dixon	male, calling and drumming
Wildcat	04	05/05/98	44.41	120.52	1337	T. K. Bryan	single
Wildcat	05	05/05/98	44.41	120.52	1387	T. K. Bryan	single
Wildcat	07	05/05/98	44.40	120.53	1482	T. K. Bryan	single
Wallowa-Whitman National Forest							
Catherine Creek	04	04/29/98	45.10	117.67	1268	R. G. Anderson	single
Dark Canyon	01	05/11/98	44.57	117.77		C. A. Miller	single, drumming
McIntyre	05	05/07/98	45.34	118.50	1384	R. G. Anderson	single
Red Gulch	07	05/05/98	44.93	117.40	1254	R. D. Dixon	single, calling and foraging
Sawtooth Ridge	01	05/10/98	44.98	117.58	1329	C. A. Miller	single, foraging
Warm Springs Indian Reservation							
Coyote Creek	07	04/29/98	44.98	121.44	882	R. D. Dixon	female, foraging
Washington							
Colville Confederated Tribes							
Owhi Flat	01	05/14/98	48.21	118.82	877	R. D. Dixon	single
Owhi Flat	02	05/14/98	48.21	118.82	920	R. D. Dixon	female, calling and foraging
Wenatchee National Forest							
Canteen Flats	02	05/19/98	46.89	120.92	1189	J. E. St. Hilaire	pair
Little Rattlesnake	02	05/09/98	46.77	121.02	945	K. R. Bevis	single, excavating
Little Rattlesnake	07	05/09/98	46.77	121.04	1190	K. R. Bevis	male, drumming
Yakama Indian Nation							

No. 802	01	08/19/98	46.14	121.01	902	R. H. Leach	single, calling
No. 802	05	04/29/98	46.16	120.97	960	R. H. Leach	single
No. 802	09	04/29/98	46.18	120.95	1042	R. H. Leach	single, drumming
No. 802	12	04/29/98	46.19	120.93	1094	R. H. Leach	pair
No. 1742	11	04/28/98	46.06	121.03	872	R. H. Leach	single, calling
No. 1742	12	04/27/98	46.05	121.03	858	R. H. Leach	single
No. 1742	13	04/27/98	46.04	121.03	850	R. H. Leach	single
No. 1742	14	04/28/98	46.03	121.03	841	R. H. Leach	single
No. 2555	11	05/01/98	46.29	120.98	1012	R. H. Leach	single, drumming
Kaiser Butte-143	02	04/21/98	46.02	121.94	1021	R. H. Leach	single, calling
Kaiser Butte-143	05	04/22/98	46.03	121.96	1003	R. H. Leach	single
Kaiser Butte-143	06	04/22/98	46.04	121.96	951	R. H. Leach	single

White-headed Woodpecker Distribution

Based on 1998 point count data.


Bailey's Ecoregion
Cascade Mixed Forest-Coniferous Forest-alpine Meadow Province
Great Plains-Palouse Dry Steppe Province
Intermountain Semi-Desert Province
Middle Rocky Mountain Steppe–Coniferous Forest-Alpine Meadow Province
Northern Rocky Mountain Forest-Steppe–Coniferous Forest-Alpine Meadow Province
Sierran Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province
White-headed Woodpecker Location
Point Count Location
Map prepared by
Leona K. Bomar.

During the first five minutes, detection distances averaged 81.219 ± 6.923 m SE (n = 32; range: 30-189 m). In addition, 39.6% of the White-headed Woodpecker detections during point counts were in "target habitat," i.e., old ponderosa pine forest types.

Density estimates for White-headed Woodpeckers ranged from 0.13 birds/40 ha in understory reinitiation habitat types to 5.36 birds/40 ha in old mixed-coniferous habitat types (Table 4). Although the highest estimated density for White-headed Woodpeckers occurred in the old mixed-coniferous habitat type, upon closer inspection, all White-headed Woodpecker detections, included in this analysis for the mixed-coniferous habitat type, were in ponderosa pine/western larch/Douglas-fir forest types. Thus, the high density estimate obtained for this habitat type is consistent with a ponderosa pine association and does not imply an association with what is typically considered a mixed-conifer forest type. Furthermore, this high density may be an artifact of unreplicated counts. Based on absolute counts of breeding White-headed Woodpeckers (Dixon 1995*a*,*b*), it is unlikely that a density this high would occur for this species. The next highest densities for White-headed Woodpeckers occurred in old ponderosa pine and mature ponderosa pine habitat types.

DISCUSSION

Our knowledge of landbird communities in ponderosa pine forest systems--especially woodpecker species--is limited. In this study, density estimates for White-headed Woodpeckers ranged from 0.00 birds/40 ha to 5.36 birds/40 ha. These values are consistent with other studies in the region. In 1991, I estimated densities of White-headed Woodpeckers in central Oregon and found 0.00-3.52 birds/40 ha (Dixon 1995*b*); in 1993, densities ranged from 0.00-2.53 birds/40 ha (Dixon 1995*a*). Bate (1995) reported densities of White-headed Woodpeckers in central Oregon of 0.00 birds/40 ha in intensively harvested sites to 6.56 birds/40 ha in lightly harvested sites. In 1997, Frenzel and Popper (1998) repeated surveys on nine study areas that I had previously established and surveyed in 1991 and 1993 and one new area that they established. Densities of White-headed Woodpeckers ranged from 0.03-1.54 birds/40 ha on the Deschutes National Forest and from 0.0-1.23 birds/40 ha on the Winema National Forest (Frenzel and Popper 1998). Contrary to my findings from 1991 and 1993 (Dixon 1995*a*,*b*), densities of White-headed Woodpeckers in 1997 were not correlated with the proportion of old-growth within 10 study areas (Frenzel and Popper 1998). However, similar to my findings in 1991 and 1993, the highest densities of White-headed Woodpeckers in this study were in ponderosa pine-dominated habitat types.

In 1975 Bock and Lepthien stated that "few studies have attempted to determine large-scale patterns of population density." Christmas count coverage of White-headed Woodpeckers in montane regions of the West is not well represented; rare species such as the White-headed Woodpecker and the Three-toed Woodpecker are often missed in areas where they are known to occur (Bock and Lepthien 1975). In an analysis of Christmas Bird Count data from 1962/63 to 1971/72, the White-headed Woodpecker was recorded at only sixteen count sites, most in the Sierra Nevada or Cascades (Root 1988). In this study (which includes only one field season), White-headed Woodpeckers were detected on 29/54 transects.

The importance of habitat-specific monitoring for White-headed Woodpeckers at a regional scale cannot be overemphasized. With the exception of continued monitoring by ODFW of transects established on the Deschutes and Winema National Forests of Oregon by Dixon in 1991 and 1993 (Dixon 1995*a*,*b*; Frenzel and Popper 1998), no other current monitoring program adequately provides data on White-headed Woodpecker populations. This is problematic considering the status of White-headed Woodpeckers in their northern range. While extensive at a regional scale, the USFS Northern Region Songbird Monitoring Program primarily covers areas at the limits of the range of White-headed Woodpeckers. This program targets songbird species and the survey period begins at the point where White-headed Woodpeckers are least vocal and therefore the least likely to be detected. No White-headed Woodpeckers were recorded at any transects within this program (Hutto 1995*b*). A study to evaluate the relationships between salvage logging and forest avifauna in lodgepole pine forests of the central Oregon Pumice Zone (Arnett et al. 1997*a*,*b*) likewise failed to detect White-headed Woodpeckers during any point counts from 1995-1997, even though these birds occur in both the Fremont and Winema National Forests.

Hanowski and Niemi (1995) recommend the use of habitat-specific monitoring for regional programs to relate changes in bird numbers to habitat changes as well as to determine natural fluctuations in bird populations. This study was habitat-specific and provides information that can be used to direct land-use decisions as they pertain specifically to White-headed Woodpeckers and pine-associated avian species. It also documents a direct relationship between White-headed Woodpeckers and their habitat across a regional landscape.

Because of the well-documented association between Black-backed Woodpeckers and post-fire communities (Blackford 1955, Koplin 1969, Davis 1976, Taylor and Barmore 1980, Harris 1982, Hutto 1995*a*, Caton 1996), this species has also drawn the attention of land managers and scientists. In the northern Rockies, the Black-backed Woodpecker "seems to be nearly restricted in its habitat distribution to standing dead forests created by stand-replacement fires" Hutto (1995*a*:1041). Hutto (1995*a*) stated, "I believe it would be difficult to find a forest-bird species more restricted to a single vegetation cover type in the northern Rockies than the Black-backed Woodpecker is to early post-fire conditions." In contrast to this, I found Black-backed Woodpeckers in a number of habitat types including ponderosa pine closed stem exclusion, old mixed-coniferous, mixed-coniferous open stem exclusion, ponderosa pine understory reinitiation, and ponderosa pine/Douglas-fir understory reinitiation--there were no detections of Black-backed Woodpeckers in post-fire habitats. However, this may be an artifact of sample size, since only four points occurred in post-fire habitats. In central Oregon, Frenzel and Popper (1998) detected Black-backed Woodpeckers in the same areas where I had observed them in 1991 and 1993. Of these four areas, two contained burns. According to Murphy and Lehnhausen (In press), Black-backed Woodpeckers occupy a burn for approximately 2-3 years, then disperse. It appears that these particular sites in Oregon are capable of supporting small populations of Black-backed Woodpeckers. Although Hutto (1995*a*) considers the possibility that Black-backed Woodpecker populations could be maintained by source refuges containing low numbers in unburned forests, he considers it equally likely that their populations are

maintained by a patchwork of recent post-fire communities, and that birds produced in these areas emigrate when conditions become less suitable, approximately 5-6 years post-fire.

Finally, this study extends our knowledge of the abundance and distribution of White-headed Woodpeckers in Oregon to a larger terrestrial ecosystem in the interior Pacific Northwest, and represents an even broader view of this species and its relation to ponderosa pine forests. The White-headed Woodpecker's dependence on mature and old-growth ponderosa pine forests in the northwest is a ongoing key issue for land managers and conservation biologists.

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APPENDIX I. Forest cover types (Society of American Foresters).

Code	Cover Type Name
SAF205	Mountain hemlock/subalpine fir
SAF206	Engelmann spruce/subalpine fir
SAF207	Red fir
SAF208	Whitebark pine
SAF210	Interior Douglas-fir
SAF211	White fir
SAF212	Western Larch--Douglas fir
SAF213	Grand fir/western larch/Douglas-fir
SAF214	Ponderosa pine/western larch/Douglas-fir
SAF215	Western white pine
SAF217	Aspen
SAF218	Lodgepole pine
SAF219	Limber pine
SAF220	Rocky Mountain juniper
SAF224	Western hemlock
SAF226	Pacific silver fir/western hemlock
SAF227	Western redcedar/western hemlock
SAF228	Western redcedar
SAF229	Pacific Douglas-fir
SAF230	Douglas-fir/western hemlock
SAF233	Oregon white oak
SAF235	Cottonwood/willow
SAF237	Interior ponderosa pine
SAF243	Ponderosa pine/sugar pine/fir
SAF244	Pacific ponderosa pine/Douglas-fir
SAF245	Pacific ponderosa pine